Marine Bioacoustics: Back to the Future

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LONG-TERM GOALS

The primary goal of our project is to provide advanced undergraduates, graduate students, and postdoctoral investigators with a broad understanding of ocean acoustics as well as the techniques used to study the ecology of marine animals *in situ*. By bringing together many of the top researchers in marine bioacoustics, biological oceanography, and marine biology, we provide students with a unique opportunity to work side by side with world experts using state-of-the-art tools and technologies. A secondary goal of the project is to provide a setting for developing and testing new technologies. In this manner, it serves as a research magnet, attracting leading scientists to conduct their own research in a creative teaching and learning environment that catalyzes interactions across the various disciplines associated with Bioacoustical Oceanography.

OBJECTIVE

To provide students with a broad understanding of the acoustic techniques used to study the distribution and behavior of marine animals in the context of their physical/chemical/biological environment.

APPROACH

Through lectures, demonstrations, and field exercises, we provide students with a unique opportunity to learn and work side by side with top scientists using state-of-the-art bioacoustic tools and techniques. Extra support was provided for the Friday Harbor summer course this year through the NSF-funded US GLOBEC Program Office at Rutgers University. This enabled us to bring in additional instructors and equipment from the Woods Hole Oceaogrphic Institution. The additional instructors and equipment allowed us to hold a mini-symposium on US GLOBEC Contributions to Marine Bioacoustics, culminating in a field experiment held in Saanich Inlet, British Columbia.

During the full summer course, the following three field projects were conducted:

1. A experimental study in Saanich Inlet to test the hypothesis that strobe lights on a MOCNESS sampling system would reduce or eliminate net avoidance by euphausiids,

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2. A passive acoustics exercsie at Lime Kiln Lighthouse to calibrate its hydrophone array and evaluate its performance in localizing and tracking orcas,
3. A fisheries acoustics cruise to demonstrate the methods used for conducting marine predator-prey studies using acoustics to define prey fields.

WORK COMPLETED

Thirteen undergraduate students were trained in an intensive, 3-week course in Conservation Oceanography offered on the Big Island of Hawaii during Winter 2011. Two of the weeks focused on the use of acoustic methods in studying the conservation biology of exploited fish stocks and endangered cetacean and sea turtle populations.

Twelve undergraduate and graduate students and one postdoctoral scholar were trained in an intensive, 5-week course in Marine Bioacoustics offered at Friday Harbor, WA during Summer 2011. Two of the weeks focused on the use of acoustic methods in studying the conservation biology of exploited fish stocks and endangered cetacean and sea turtle populations. All field work on course-related projects has been completed. Several students are continuing to analyze their data and are planning to prepare manuscripts for publication.

RESULTS

Highlights of student experiences include:

1. Successful experiment demonstrating that strobe lights can eliminate net avoidance by euphausiids, (Figure 1),
2. Student project to evaluate multi-frequency inversion methods demonstrated sensitivity to various assumptions and suggested mechanisms for constraining solutions to improve confidence,
3. A bounded variable least squares algorithm was developed as alternative method to the non-negative least squares algorithm for solving the multi-frequency inversion problem.

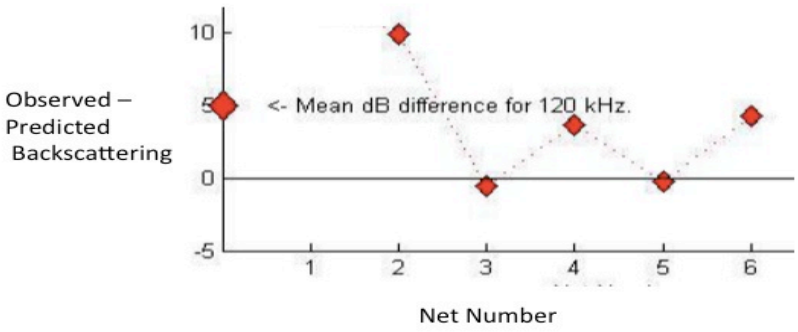

Figure 1. Difference between forward problem predictions of acoustic backscattering from MOCNESS samples and observed measurements at 120 kHz. Nets 2, 4, and 6 correspond to strobe off; nets 3 and 5 correspond to strobe on.

IMPACT/APPLICATIONS

Students from around the world come to these courses because they provide the best training available in Marine Bioacoustics. The 26 student participants in this year's courses, eight of whom came from other countries, bring our total number of students since 1993 up to 237 students from 30 different countries. The research accomplishments this year demonstrate how our courses have acted as research magnets, attracting top scientists to integrate their own research with our educational program. Alumni from our courses have become national and international leaders in the fields of Marine Bioacoustics and Bioacoustical Oceanography, and we are now training the second generation of students in this field (training the students of our former students).

TRANSITIONS

None.

RELATED PROJECTS

None.